

APPENDIX Q
DETAILED DESCRIPTION OF ALTERNATIVES AND FACILITIES

All figures are based on pre-design. During final design, alignment, sizes, building layouts, and architectural details could change.

ALTERNATIVE 1 - CSO STORAGE AND CONTROL

South Lake Union Subbasin Facilities (see Table 3-1 and Figure 3-1)

The facilities in the South Lake Union Subbasin connect CSOs from Seattle's Phase 1 project in east Lake Union, the existing Lake Union Tunnel and the existing Central Trunk to the new Mercer Street Tunnel for storage and conveyance to the Elliott West CSO Control Facility. The tunnel and control facility are in the Elliott Bay Subbasin although the East Tunnel Portal Drop Structure is included in the South Lake Union Subbasin.

Outfalls

CSO #125 - The CSO outfall flows into the southeast corner of Lake Union at the children's playground on the lake at Fairview and is owned by Seattle. The 24-inch diameter outfall pipe would be cut off on shore and the end filled with concrete before reburial. Sewers no longer in use would be abandoned.

Conveyance (Figure Q-1)

CSO #175 - The CSO outfall flows into the east side of Lake Union at Garfield Street and conveys CSOs from Capital Hill and runoff from Interstate 5. The outfall is jointly owned by Seattle and the Washington State Department of Transportation. The project would improve the transport of flows to the Valley Connection and eliminate overflows at the outfall. To improve transport, approximately 1,950 feet of 12- to 30-inch sewer would be constructed on the east side of Interstate 5 in Lakeview Boulevard between East Galer and East Prospect rights-of-way and under Interstate 5 to Eastlake Avenue East.

Valley Connection - The approximately 800 lineal feet of up to 60- to 72-inch pipeline would be about constructed between Fairview Avenue and Westlake Avenue North by open trenching north of the travel lanes of the Valley Street right-of-way. A manhole at Valley and Fairview constructed as part of Phase 1 would be modified to split flows, allowing low flows to continue through the existing sewer network to the existing Lake Union Tunnel. The pipeline would convey high flows from Phase 1 and CSO #175 to the South Lake Union CSO Pipeline and from there to the new Mercer Street Tunnel.

South Lake Union CSO Pipeline - The pipeline would be about 900 lineal feet of 72- to 84-inch diameter pipe to convey high flows from east and south Lake Union to the new Mercer Street Tunnel. The pipeline would be located in the Broad Street, Roy Street and Valley Street rights-of-way between Terry Avenue and the East Tunnel Portal Drop Structure. It is assumed that due to traffic restrictions, the west end of the pipeline would be bored and jacked. The remainder of the pipeline would be open cut.

figure q-1

Lake Union Tunnel CSO Pipeline - The pipeline would be approximately 700 lineal feet of 72- to 84-inch diameter pipe to convey excess flows from the existing Lake Union Tunnel to the new Mercer Street Tunnel via the South Lake Union CSO Pipeline. The pipe would be placed in the westernmost lanes of Westlake Avenue North from the existing Lake Union Tunnel at Republican Street to the intersection of Valley and Broad. It is assumed that the pipeline would be bored and jacked.

Central Trunk CSO Pipeline - The pipeline would be about 300 lineal feet of 54- to 84-inch diameter pipe in Roy Street between the new Central Trunk Diversion Structure and the East Tunnel Portal Drop Structure to convey Dexter overflows from the existing Central Trunk to the new Mercer Street Tunnel. It is assumed that the pipeline would be installed using open cut methods.

Regulating Structures

Central Trunk Diversion Structure - The structure would divert flows from the existing Central Trunk to the new Mercer Street Tunnel to reduce overflows into Lake Union at the Dexter outfall to once per year. The excavation would be approximately 22 feet by 25 feet and 22 feet deep and constructed in Dexter Avenue North at Roy Street. There would be no mechanically- or electrically-operated devices in this structure.

Lake Union Tunnel Regulator Station - The regulator would regulate flows into and out of the existing Lake Union Tunnel and divert overflows to the new Mercer Street Tunnel via the Lake Union Tunnel CSO Pipeline. The regulator excavation would be 24 feet by 35 feet and 50 feet deep. The facility would have backup power and safety features for human entrance during maintenance activities. Construction may include installation of a 66-inch diameter liner in the eastern 600 feet of the existing Lake Union Tunnel.

CSO Control

Elliott West CSO Control Facility - The CSO control facility would be located on the Elliott West site and under Mercer and Roy Streets between Broad Street and Elliott Avenue and is described in detail under the Elliott Bay Subbasin. The East Tunnel Portal Drop Structure would be the only control component in the South Lake Union Subbasin.

East Tunnel Portal Drop Structure - This portal would serve as the extraction area for the tunnel boring machine upon completion of the tunnel mining operation and for inflow of CSOs from the existing Central Trunk, east and south Lake Union, and flows from the existing Lake Union Tunnel to the new Mercer Street Tunnel. The portal drop structure would be approximately 45 feet by 48 feet and 63 feet deep and located in Roy Street just west of Broad. It is assumed that Roy Street between Dexter and Broad would be closed for approximately one year for construction. The drop structure would vent when the tunnel fills with wastewater. It is anticipated that this air would require odor control (e.g., carbon adsorber).

Elliott Bay Subbasin Facilities (see Table 3-2 and Figure 3-1)

The facilities in the Elliott Bay Subbasin convey and store flows from South Lake Union Subbasin and the existing Lake Union Tunnel to the Elliott West CSO Control Facility. A connection to the EBI also allows flows from the EBI to be stored and/or treated at the Elliott West site or flows from the new Mercer Street Tunnel and existing Lake Union Tunnel to be pumped into the EBI for conveyance to and treatment at West Point.

Outfalls

Most of the outfall elements would be built by floating construction equipment such as derrick barges to lift pipe sections, dredge unsuitable soils, place rock and gravel fills, and provide a platform to construct the transition structure. Supporting the derrick barges would be deck barges, tugs and work boats. Construction of the transition structure would require driving steel sheet piling. Concrete construction would require shore-based concrete trucks and concrete pumps. Also, based on shore would be dewatering pumps, laydown area, and a construction access road. Figures Q-2 and Q-3 show the site plan and pipeline construction for the outfalls.

Elliott West Outfall - The new effluent outfall would require approximately 490 lineal feet of 96- to 108-inch marine pipe to disperse effluent from the Elliott West CSO Control Facility into Elliott Bay at approximately 60 to 70 feet below Mean Lower Low Water (MLLW) level. A transition structure onshore would also be constructed. Marine construction would require dredging a 60- to 80-foot wide trench to a depth of about 16 feet. The outfall trench could include both this effluent outfall and the Denny Way CSO Outfall Extension. The pipes would be covered with a concrete mattress except for the exposed end discharge structures. A diffuser is not expected to be required on the end of the outfall pipe.

Denny Way CSO Outfall Extension - The extension would be approximately 90 lineal feet of 96- to 120-inch diameter marine pipe to extend the existing Denny Way CSO outfall approximately 10-20 feet below MLLW. The outfall could be constructed in the same trench as the Elliott West Outfall. A diffuser is not expected to be required on the end of the outfall pipe.

Conveyance

Both pipes would be placed along the western edge of the Cargill grain terminal compound and within the Alaskan Way right-of-way through Myrtle Edwards Park and using open cut trenching (Figure Q-4). These pipeline alignments would be located about 200 feet west of the Elliott Bay Interceptor alignment.

Elliott West Effluent Pipeline - The pipeline would be approximately 3,000 lineal feet (about half a mile) of 96- to 108-inch diameter pipe connecting the control facility to the Elliott West Outfall. The alignment for the pipeline could be down the 50-foot Alaskan Street right-of-way between the railroad tracks, down Elliott Avenue to Denny Way, or under the railroad tracks and through Elliott Bay Park. The pipeline would be outside the fenceline and in the Port of Seattle park area, but no facilities would be located within Seattle park property. Boring and jacking would be required to construct the pipeline under the railroad tracks with the remainder of the pipeline

Figure Q-2

figure q-3

figure q-4

constructed using open cut methods. Construction would require a 25-foot wide construction easement and construction would occur during normal working hours.

Elliott West CSO Pipeline - The pipeline would be approximately 2,600 lineal feet of 72- to 84-inch diameter pipe from the Denny Way Diversion Structure at the west end of the existing Lake Union Tunnel to the Influent Pump Station. This pipeline could be placed in the same trench as the Elliott West Effluent Pipeline.

Dechlorination Pipeline – The pipeline would be approximately 3,100 feet of 2-inch diameter pipe constructed in the same trench with the Elliott West Effluent Pipeline and Elliott West CSO Pipeline. The pipeline would convey sodium bisulfite from storage at the Elliott West site to just upstream of the outfall pipe for dechlorination of effluent.

Regulating Structures

Denny Way Diversion Structure - The underground structure would be located in Myrtle Edwards Park at Denny Way to control flows from the west end of the existing Lake Union Tunnel to the Elliott West CSO Control Facility. The structure would be excavated 40 feet by 18 feet and 15 feet deep.

Elliott Bay Interceptor Control Structure - The underground structure (40 feet x 15 feet x 60 feet deep) would be located in the Alaskan Way ROW between the railroad tracks and above the existing Elliott Bay Interceptor (EBI). The structure would convey flows between the interceptor and the Elliott West CSO Control Facility. EBI flows could be transferred to the control facility for treatment or the tunnel for storage. Flows from the control facility could be transferred to the EBI for conveyance to and treatment at West Point.

CSO Control

Elliott West CSO Control Facility - The CSO control facility (160 feet x 130 feet x 93 feet deep) would be located on the Elliott West site (545-601 Elliott Avenue West) and under Mercer and Roy streets between Broad Street and Elliott Avenue (Figure Q-5). The facility would include construction of the following components: tunnel (including portals), influent pump station, flow control structures, floatable materials control, and chemical storage. The treated discharge capacity of the treatment components is planned for 250 mgd. Figures Q-6 through Q-9 are the exterior elevations for each side of the buildings. Figure Q-10 is the facility building layout and Figure Q-11 is a sectional view of a portion of the same facility. Final facility configuration and size would be determined during pre-design. The tunnel would not be in use during dry weather flows. Wet weather flows would enter the treatment facilities by gravity. The individual components are described below:

Mercer Street Tunnel - The tunnel would be approximately 6,200 lineal feet (about one mile) and 14- to 16-feet in diameter and constructed between Broad Street in South Lake Union and Elliott Avenue. The tunnel would store and convey up to approximately 7.2 MG of CSOs. A tunnel boring machine (TBM) would be used to mine the tunnel from west to east under West Mercer Street ROW east of Elliott Avenue West, continuing under Mercer Street to the Seattle Center parking garage, jogging to the north under the garage for one

Figure Q-5

Figure Q-6

Figure Q-7

Figure Q-8

Figure Q-9

Figure Q-10

figure q-11

block to Roy Street, then continuing east under Roy Street to an east portal to be located in Roy Street near Eighth Avenue North. The entire alignment is located within public right-of-way or under the parking garage. It is assumed that groundwater would be encountered along the tunnel alignment requiring dewatering. The Elliott West site would be used for staging of the mining operation and for materials stockpiling, the concrete grout plant, spoils removal and transfer, and tunnel liner stockpiling.

West Tunnel Portal - The West Tunnel Portal would be located on the Elliott West site and measure about 100 feet by 100 feet by 50 feet deep. The West portal includes overexcavation for tunnel boring machine assembly, temporary tieback wall, traffic control, and other appurtenances. In addition, it is assumed that the mining operations would commence at this location. During construction, spoils, tunnel liners, and other equipment would be extracted on the Elliott West site. During operation, CSOs would flow through the pipe from the tunnel to the Elliott West CSO Control Facility.

Pump Effluent Channel - This component would be a submerged tank on the Elliott West site approximately 142 feet by 29 feet by 36 feet deep with baffles or screens that would remove floatables. The floatables and sediments would be placed into the EBI for conveyance to the West Point Treatment Plant.

Influent Pump Station - The influent pump station would be constructed for 250 mgd pumping capacity to pump flows from the EBI and Elliott West CSO Pipeline to the storage/treatment component. Treated effluent would flow by gravity through the Elliott West Outfall to Elliott Bay. The pump station excavation would be approximately 103 feet by 49 feet and 93 feet deep. Approximately one and a half stories would show above ground. A flow control structure would include the influent control structure, EBI control structure and 84-inch diameter pipeline between the two control structures. Approximately 3 megawatts of electricity would be required by both pump stations. The electricity would be supplied by Seattle City Light's Broad Street Station. The new lines would be placed on power poles along or in conduits under Elliott Avenue.

Chemical Storage and Feed Facilities - This component stores chlorination and dechlorination chemicals. It would be attached to the influent pump station housing and include two sodium bisulfite and four sodium hypochlorite storage tanks and associated pumps under a covered breezeway. The facility would be approximately one and a half story aboveground and require a 147 feet by 34 feet by 30 feet deep excavation.

System Drain - A 300-foot long, 84- to 96-inch diameter pipeline extending from the new Elliott West CSO Control Facility to the new EBI Control Structure to control flows into and out of the control facility.

ALTERNATIVE 2 - PARTIAL SEPARATION AND STORAGE

South Lake Union Subbasin Facilities (see Table 3-5 and Figure 3-2)

The facilities in the South Lake Union Subbasin connect CSOs from Seattle's Phase 1 project in east Lake Union, south Lake Union, and the existing Central Trunk and overflows from the existing Lake Union Tunnel to the new South Lake Union CSO Control Facility for storage before conveyance to the EBI through the existing Lake Union Tunnel and on to West Point for treatment. Most pipelines would be installed using open-cut trenching.

Outfalls

CSO #125 - The CSO outfall flows into the southeast corner of Lake Union at the children's playground on the lake at Fairview and is owned by of Seattle. The outfall pipe would be cut off on shore and the end filled with concrete before reburial. Sewers no longer in use would be abandoned. This element is the same as for Alternative 1.

South Lake Union Overflow - The overflow conveys separated stormwater to Lake Union and also serves as an emergency overflow for the South Lake Union CSO Control Facility. The overflow pipe would be 72-inch diameter and approximately 1,500 lineal feet long from Republican to Lake Union in Terry Avenue North.

Conveyance

CSO #175 - The CSO outfall flows into the east side of Lake Union at Garfield Street and conveys CSOs from Capital Hill and runoff from Interstate 5. The outfall is jointly owned by Seattle and the Washington State Department of Transportation. The project would improve the transport of flows to the South Lake Union CSO Control Facility and eliminate overflows at the outfall. To improve transport, approximately 1,950 feet of 12- to 30-inch sewer would be constructed on the east side of Interstate 5 in Lakeview Boulevard between the East Galer and the East Prospect rights-of-way and under Interstate 5 to Eastlake Avenue East. This element is the same as for Alternative 1.

Phase 1 Connection - The 60-inch diameter pipeline would be about 1,600 lineal feet (about one-third of a mile) constructed between the Phase 1 pipeline to the South Lake Union CSO Control Facility. The exact alignment is determinant upon the selected site for the storage tank. Phase 1 flows would be stored until capacity exists in the EBI and at West Point for treatment. Flows would move from the control facility through the existing Lake Union Tunnel to the EBI.

South Lake Union Stormwater Pipelines - The pipelines would be approximately 10 miles of 12- to 84-inch diameter pipe placed in most street rights-of-way in the area bounded by Garfield, Interstate 5, Denny, Virginia, 7th, Dexter, and Galer. The pipelines would separate stormwater from wastewater and would convey the stormwater to the South Lake Union Overflow for conveyance to Lake Union.

Central Trunk Diversion CSO Pipeline - The pipeline would be about 1,500 lineal feet of 36-inch diameter pipe in Dexter and Mercer between the new Dexter Avenue Diversion Structure and the South Lake Union CSO Control Facility to convey Dexter overflows from the existing Central Trunk. The exact alignment is determined upon the selected site for the storage tank.

Control Structures

Dexter Avenue Diversion Structure - The structure would divert flows from the existing Central Trunk to the new Mercer Street Tunnel to reduce overflows into Lake Union at the Dexter CSO to once per year. The excavation would be approximately 24 feet by 24 feet and 22 feet deep and constructed in Dexter Avenue North near Roy Street.

CSO Control

South Lake Union CSO Control Facility - The control facility would store CSOs from the west, east and south side of Lake Union until capacity was available in the EBI and at West Point for treatment. The flows would be pumped from the tank to the existing Lake Union Tunnel for conveyance to the EBI. The individual components are described below:

Storage Tank - The 8.6 MG storage tank would be approximately 400 feet by 250 feet and 10 feet deep placed on a block between Valley Street, Broad Street, Eighth Avenue North, Thomas Street, and Fairview Avenue North. A low flow channel would be included in the tank design to convey low flows by gravity directly into the tunnel rather than store low flows. Approximately 600 feet of the tunnel would be replaced by the storage tank.

Pump Station - A 10 mgd pump station would pump stored flows into the existing Lake Union Tunnel.

Elliott Bay Subbasin Facilities (see Table 3-6 and Figure 3-2)

The facilities in the Elliott Bay Subbasin convey and store flows from the existing Lake Union Tunnel and the Denny local wastewater flows to the Denny CSO Control Facility. New stormwater pipes convey stormwater from the subbasin to Elliott Bay. A connection to the EBI also allows flows from the EBI to be stored at the Elliott West site or flows from the storage tank or tunnel to be pumped into the EBI for conveyance and treatment at West Point.

Outfalls

Elliott Bay Stormwater Outfalls - Four new outfalls would be necessary to convey the separated stormwater to Elliott Bay. The new outfalls would range in diameter from 42- to 84-inches. The potential locations for the outfalls are off Myrtle Edwards and Elliott Bay Parks at Cedar, Denny Way, Thomas, and Republican. The outfalls would be placed close to shore.

Conveyance

Elliott Bay Stormwater Pipelines - The pipelines would be approximately 14 miles of 12- to 84-inch diameter pipe placed in most street rights-of-way in the area bounded by Western, Battery,

4th, and Virginia, as well as the area bounded by Elliott Bay, Howe, W Mercer, 10th Ave W, Denny, and 4th Ave N (Figure Q-12). The pipelines would separate stormwater from wastewater and would convey the stormwater to the four new outfalls for conveyance to Elliott Bay.

Elliott Avenue Pipeline - The pipeline would be approximately 2,600 lineal feet (about half a mile) of 60-inch pipe from the Denny Way Diversion Structure at the west end of the existing Lake Union Tunnel to the Denny CSO Control Facility. Most of the pipeline would be located in existing rights-of-way and require a 25-foot wide construction easement. It is assumed that construction would occur during normal working hours.

Regulating Structures

Denny Way Diversion Structure - The underground structure would be located in Myrtle Edwards Park at Denny Way to control flows from the west end of the existing Lake Union Tunnel to the Denny CSO Control Facility. The structure would be excavated 16 feet by 18 feet and 19 feet deep.

CSO Control

Denny CSO Control Facility - The CSO control facility would be located on the Elliott West site. The facility would include construction of the following components: influent and effluent pump stations, flow control structures, and storage. Wet weather flows would enter the storage component by gravity. The individual components are described below:

Storage Tank - This component would be an 8 MG facility (approximately 250 feet by 250 feet and 20 feet deep) that would store CSOs until capacity exists in the EBI and at the West Point Treatment Plant. Figure Q-13 is a example plan view and landscaping for a storage facility on the Elliott West site. Figure Q-14 is a sectional view of the same facility.

Influent and Effluent Pump Stations - The influent pump station would be constructed for 72 mgd pumping capacity to pump 6 MG from the EBI and additional flows from the Elliott Avenue Pipeline to the storage component. The effluent pump station would be constructed for 20 mgd pumping capacity to pump stored flows from the storage tank to the EBI for conveyance to West Point for treatment. The pump station excavations would be approximately 32 feet by 80 feet and 40 feet deep for the influent pump station and 8 feet by 20 feet and 40 feet deep for the effluent pump station. A flow control structure would include the influent control structure, EBI control structure and 84-inch diameter pipeline between the two control structures.

Figure Q-12

Figure Q-13

Figure Q-14